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ELECTRICOLOGY



A

DISCOURSE

UPON

ELECTRICITY.



(Price One Shilling.)

Second Edition.



ELECTRICOLOGY:
OR, A
DISCOURSE
UPON
ELECTRICITY.
BEING

AN ENQUIRY into the NATURE; CAUSES;
PROPERTIES; and EFFECTS thereof, upon
the Principles of the *ÆTHER*.

ILLUSTRATED

By a Series of Surprizing EXPERIMENTS.

CONTAINING,

Every Thing curious in this Branch of Philosophy,
that has been communicated by Professor MUSCHEN-
BROEK; LE MONIER; L'ABBE NOLET, &c. abroad;
and by Messieurs WATSON, MARTIN, and other *Literati*
at Home: With several new and conclusive Ones; and
particularly, the surprizing PHENOMENON of the
SENSITIVE PLANT, and wonderful benumbing Property
of the TORPEDO, are herein explain'd and accounted
for.

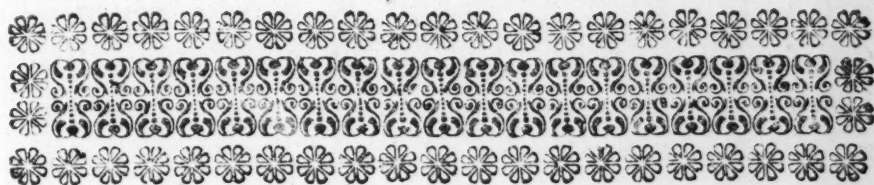
By *R. TURNER*.

*O quam multa sunt opera tua, JOVA! qui cuncta sapienter
fecisti,*—

WORCESTER:

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To the READER



PHILOSOPHY is that Branch of Learning, which contemplates the *Existence* and *Perfections* of the *Great Author* of *Nature*, in all those *Stupendous Works* which *He* has, so *harmoniously* and *elegantly*, dispers'd around us. — 'Tis *this* that *ennobles* the *Conceptions* *exalts* the *Ideas*, and *elevates* the *Soul* far above the usual Way of Thinking: whilst Numbers, nay the *greatest Part* of Mankind *rise*, *walk*, and *lye* down amidst *Millions* of *Wonders* constantly *glowing* around 'em, with little or no other *Reflection*, or *Observance*, than — the *Sun rises* and 'tis *Day*: — *it sets* and 'tis *Night*. — They *may*, and indeed *do* perceive enough to convince them, of the *Existence* of *one eternal*

A Being,

Being, Creator of all Things, the God of Order and Harmony ; but it is the *Philosopher alone*, can feel the true Spirit and Warmth of the *Royal Psalmist's* Exclamation, *How Manifest are thy Works, O Lord, in Wisdom hast thou made them all!*

HUMAN KNOWLEDGE has, within the Compass of a *very few* Years, made large *Incurfions*, and *penetrated* deeply into the *wond'rous Works of Nature*; the *Laws* of their *Motions*; *Causes* and *Effects*; and, by fuch Discoveries, has not only produc'd *fresh Themes* for the *Creators Praise*, but *fully verifies* the antient Observation of Job. *Lo! these are only PART of thy Ways.* ——— for every recent Discovery is an evident Proof, that his *Wisdom* is *Infinite*; and, that *Numberless Beings* with all their *Relatives*, remain *still* to be discover'd, which the *present Generation* has no more Idea of, than *those*, long before us, had of the *Virtues* of the *Magnet*, or *Wonders* of the *Microscope*.

ONE of these *Surprizing Phenomena*, we just begin to have an imperfect Glimpfe of, that is, the *Virtues* of the *Electric Fire*; *astonishing* in many Respects; whether we con-
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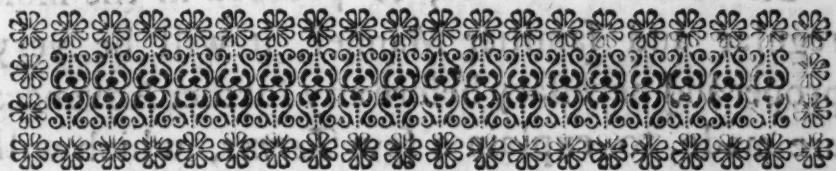
sider its *incredible Elasticity*, and *Velocity*,^{*} its *wonderful Properties* of *Attraction* and *Repulsion*; or *amazing Operations* on the *Bodies* of *Animals* and *Vegetables*: but the adæquate Knowledge of the *Laws* by which it is govern'd, the *full* and *various Uses*, and *Advantages* to Mankind *resulting* from it, together with its *true Cause*, may perhaps be reserv'd for the happy Discovery of *future Generations*.———In the mean Time, as Induction from *Effects* to *Causes*, or from the *Existence* of such and such *Phænomena* to the *Powers* Producing them, is, in Conjunction with a Variety of repeated Experiments, the

* Its *Velocity*, is in all Probability, Equivalent to that of Light which Flies, with incredible Swiftneſs, through the Space of 10 Millions of Miles per Minute.

Note. Light moves faster than Sound 680 Thousand Times.

best Way of Arguing which Things of this Nature admit of, in Order to arrive at the Fountain Head; so, whether the following Collection of Experiments *accurately made*, shall be esteem'd to contribute any Thing towards this *End*, is submitted to the Candour of *those*, who have Time, or Inclination to enquire, and Judgment to Examin.

A D I S-



A

DISCOURSE

UPON

ELECTRICITY.



SINCE the various and wonderful Experiments in *Electricity*, which of late have been exhibited in this Kingdom, and other neighbouring Nations, have universally engross'd the Attention, as well as Conversation of the curious and polite Part of the World; it is very reasonable, we should make a strict and punctual Enquiry, into the *Causes*, *Properties*, and *Effects* thereof, and also be very thoughtful and inquisitive, concerning the *Uses* and *Advantages* in Life, that may arise to Mankind, from such an admirable and amazing *Power of Nature*.

B

IN

IN order, therefore, to proceed in the most regular and familiar Manner, it will be very proper and ^{indeed} necessary before any further Advances are made, to explain a few *Terms*, which will frequently occur in this Course of *Electric Experiments*. And,

First, Electricity, which is deriv'd from ἤλεκτρον, *Greek*, signifying *Amber*, for it was well known, long ago, to be the Property of that Body, when rub'd with a dry Hand, Woollen-Cloth, &c. to emit small *Particles* of Matter, which would attract and repel alternately, light Bodies at a Distance; and therefore the Name *Electricity* has been given to that attractive and repulsive Force, which is excited in any other Body, by the same *Friction* as is given to the *Amber*.

Secondly, ALL Bodies in the Universe may properly be divided into two CLASSES, viz! *Electric* and *Non-Electric*; those Bodies which attract and repel under the Circumstances of Attrition or Rubbing, are said to be *Electric*; but, those in which this Virtue will not be so excited, are said to be *Non-Electric*.

Thirdly,

Thirdly, WHEN any strange or surprizing Appearance in Nature presents itself to our View, it is call'd a *Phænomenon*; but, if several of those Appearances are visible, they are called *Phænomena*.

Fourthly, THOSE small *Parts* or *Particles* of Matter, which are emitted from *Electric Bodies* by Friction, are called *Effluvia*, sometimes *Electric Virtue*; but if they are thrown out in such Plenty as to shine, they then constitute what is called an *Electric Fire*.

Lastly, ALL Bodies upon which the *Electric Virtue* is thrown, are said to be *electrified* or *electrized*; and this *Electrification* or *Electrization*, can be perform'd only to a certain Degree; for *electrified Bodies* retain only a determinate Quantity thereof; all above that Standard dissipating itself into the Air as fast as emitted from the *Electrical Body*.

THE *Ancient Philosophers* had very rude and barbarous Notions, or Conceptions, concerning the Nature of *Electricity*: And indeed, some of the *Modern* have been much confus'd and bewilder'd in their Researches into the

Cause of this most wonderful and amazing Property of *Electric Bodies*; and have endeavour'd to account for those surprizing and astonishing *Phænomena*, upon such absurd and ridiculous *Hypotheses*, as are quite inconsistent with the Laws of *experimental* or *true Philosophy*. *

WITH a View therefore of arriving at the true Cause of *Electricity*, we must have recourse to the *Æther*, which is a most *fine*, *subtile* and *invisible Fluid*, diffus'd through the whole Expansion of Space; also, endued with the highest Degree of *Elasticity*, and, does by its Spring and Subtilty, easily pervade, and run through the Pores and Interstices of all Bodies in the Universe.

AND that such a subtile Matter, as now mention'd, does actually exist in *Nature*, may plainly and clearly be demonstrated, by the following surprizing Experiment.

LET a large *Magnetic Needle*, supported upon a Stand, be set on a Table near the Edge; then

* See the Opinions of the *Peripateticks*, *Cartesians*, and other eminent Philosophers, in *Chambers's Dictionary*, or *Harris's Lexicon Technicum*, under the Word *Electricity*.

then taking a *Steel Bar* about two or three Feet in Length, and holding it in a Direction perpendicular to the Horizon, approach the North End of the Needle, with the lower End of the Bar, and the Needle will be immediately repel'd from it; then let the Needle come to rest again; and stooping down, approach the same End of the Needle, with the upper End of the Bar, and the Needle will be strongly attracted by it; but, upon inverting the Bar, the attractive and repulsive Powers instantly change Places, as is evident, by applying the Bar to the Needle, in the same Direction as before; for that End which then attracted, will now repel, and that which before repel'd, will now attract.

What can be the Cause of this wonderful and surprizing *Phænomenon* if it be not the *Æther*? Which by its Subtily, and natural Tendency to the Center of the Earth, pervades, and makes its Way thro' the Pores of the Bar, causing it, whilst held in that perpendicular Direction, to acquire Poles like the *Magnet* or *Loadstone*, viz. one End, at which the *Æther* rushes in, and the other, at which it passes out, 'tis plain, it cannot be any Effect arising from the Power of the Air, because it acts exactly the same in every Respect in an *exhausted Receiver*.

T H E R E

THEREFORE it is very evident, that this *Subtile Matter* does really exist; and that it runs through the Pores of different Bodies, in various and different Directions; and that its *constituent Particles* are infinitely smaller than those of *Air*, or even of *Light itself*.*

Now as this *Æther* or *Subtile Matter* [which is the Principal Cause of all *Electric Phenomena*] is, of a very *elastic* Nature, it will reasonably follow, that those Bodies whose Parts are capable of being put into a vibratory Motion, will throw it out, and if plentifully, they prove *Electric*: But, such Bodies, whose Parts cannot conceive a vibratory Motion by Friction, will not throw it out, consequently they must prove *Non-electric*. And this Deficiency in Bodies, seemingly arises from the want of a natural *Elasticity* of the Parts which compose them: For, *Venice Turpentine*, is, in its natural State a *Non-electric*; but if boil'd in Water to separate the Oyl, there will remain a Rosin, which when dry'd and rub'd, proves very hard, frangible, and *Electric*.

BUT,

* Amber rub'd in *Vacuo*, will attract and repel, and in the Dark emit Light, which fully proves the Existence, Subtlety, Elasticity, &c. of this subtile Medium all at once.

(II)

BUT, here it must be observ'd, that there are some Bodies, which tho' they are endued with a very great Degree of *Elasticity*, yet will not, when violently agitated by Friction, emit those *Effluvia* so copiously as to be accounted *Electric*: For, Bell-metal is very *elastic*; extremely *brittle*, and also breaks with a *Polish*; yet, when rub'd, shews no Signs of *Electricity*. Hence it is evident, that there must be some other Property inherent in Bodies, besides *Elasticity*, to constitute them *Electric*: And this seems to be that particular Disposition, or Situation of the Pores, which renders Substances, in some Degree, either *pellucid* or *transparent*. And 'tis a *Quere*, if two Bodies are equally *elastic*, whether that which has the greatest Degree of *Transparency*, will not be the most productive of *Electricity*.

BECAUSE, in very *elastic Bodies*, whose Pores are situate nearly in a *rectilineal Direction*, as in *Amber*, *Agate*, *Glass*, &c. the *Aether* will, when the Body is put into a *vibrating Motion*, be emitted in great Plenty, as having nothing to obstruct its Emission: But just the contrary must happen in Bodies, tho' *elastic*, when the Situation of their Pores are very *oblique*;
as

as in *Steel*, *Silver*, &c. for in them the *Æther*, as the Particles *vibrate*, is, as it were wedg'd up, and consequently very little or none of it can be evacuated. For this Reason, *Tersion* or Wiping† is very necessary, as well as *Attrition* or Rubbing, to produce *Electricity*; because the *Effluvia* can issue out more plentifully when there is nothing to stop up, or choke the Pores of the *Electric Body*.

THIS being premised, I shall now proceed to the EXPERIMENTS themselves, as they are made at the Distance of an hundred Feet from the *Machine*; with a new, curious, and complete *Apparatus*, peculiarly adapted to the Purpose: And likewise shall evidently shew, how all the various and surprizing *Phænomena* exhibited in these EXPERIMENTS, are easily explicable upon the foregoing Principles of the *Æther*.

† As very justly observ'd by Mr. *Boyle*, Mr. *Hawksbee*, Mr. *Martin*, &c.

EXPERIMENT I.

A GLASS Globe or Spheroid twelve Inches in Diameter by means of a large Wheel, is made to revolve upon its Axis, with great Rapidity, a Cushion, or a dry Hand bearing against it, will put the Particles that constitute it, into a *Vibratory Motion*; and at each Vibration or Impulse, there will be thrown out of the Pores or Interstices of the Glass, the above-mention'd *Subtile Matter**; (with such prodigious *Velocity*, as to excite an Idea of Light in a darken'd Room) and may plainly be seen to rowl upon the Surface of the Glass, like Water upon a Grinding Stone: And if a Finger or Hand, be brought near the Globe, the *Effluvia* will strike against it like a gentle Blast of Wind, but with a crackling and hissing Noise, something resembling a Bay-Leaf in the Fire.

EXP. II.

IF a Gun Barrel suspended upon *Silk Ropes*, having a Card inserted into the Breech thereof, be brought to touch the Globe, the *Electric Virtue* will run upon the Card, by which it

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will

* So an Orange Kernel held between the Finger and Thumb, will, when gently squeez'd, fly out with great Swiftneſs to the Distance of 30 or 40 Feet,

will be convey'd to the Barrel; and, upon touching it, *i. e.* the Barrel, the *Effluvia* will forcibly burst out at that Place, like a small Flash of *Lightning*. Hence it appears, that the *Electric Virtue* which before was diffus'd upon the whole Superficies of the Globe, in a very *lax* Manner, is now brought into one *collective Point* in the Gun-Barrel. But the *Reason* why the *Electric Fire* thus bursts out, is, because the *Æther* is much rarer within the Pores of Bodies themselves, than without in open, free Places; so when a Finger or any *Non-Electric* approaches the Barrel, the *Æther* between them, will become rarer than before, and upon this State of the *interjacent Æther*, it will follow, that the *circumambient Æther*, will act more sensibly towards that Part where it is rarified, and thus according to the universal Law of Fluid Substances, the *Electric Virtue* will flow towards those Parts where there is least Resistance, and consequently run off upon the Finger.

EXP. III.

IF an *Iron Chain* 100 Feet in length, be supported upon *Silk Cords* round a Room, or to the further End where it communicates with,
and

and fufpends a *Brass Cannon*, be hung by a Hook upon the Gun-Barrel, the *Electric Virtue* will, in the Twinkling of an Eye, be transmitted thro' the whole *Chain*, and *Cannon*; and will appear upon the Approach of a Finger, and be heard to snap, and ftrike againft it with much greater Force, than from the Gun-Barrel itfelf. The *Reason* is, becaufe all Metals, particularly *Iron*, contain a great Quantity of *Sulphur*; now fome of thofe *sulphureous Particles*, may, by the exceffive Impetuofity of the *Electric Virtue*, be diffolv'd and take Fire; and therefore continually increafe the Intenfeneff thereof.

EXP. IV.

IF a large Tin Tube, having two fmall Ones, branching out at one End thereof, each about 1-10th of an Inch in Diameter, be put into the Mouth of the Cannon, there will iffue out, two large Flames of *Electric Fire*, diverging every Way from the Ends of the fmall Tubes, like the Sun's Rays from the *Focus* of a *Burning-Glass* in a darken'd Room. Thefe Streams greatly refemble the Flashings and Streamings of the *Aurora Borealis*, or *Northern-Lights*.

If at the same Time, the Back of the Hand be held near the said *Flames*, they will be felt to blow against it very sensibly, and if the Hand be brought still nearer, the Rays will be condens'd in such a Manner, as to run out of the small Tubes upon it, in two Streams of *dense yellow Fire*, which has a very strong acid Smell, much resembling in that respect, the Fire of *Phosphorus* *, but if any Person lays his Finger upon any Part of the Chain, the Flames at the Cannon instantly disappear, because the *Electric Virtue* runs off upon the Finger as a *Non-Electric*, and therefore cannot go to the Ends of the Tubes to emit the Flames, as it does when the Finger is not in Contact with the Chain. *Note*, This one Experiment is made best at the Gun-Barrel, when the Chain is taken off, because then the *Electric Fire* is not so much condens'd, but goes off in greater dilated Flames.

EXP. V.

A GLASS Tube about Twelve Inches long, and 3-4ths of an Inch in Diameter, ferrol'd at Top,

* This Smell is different when emitted from different *Electric Bodies*, whence we may reasonably conclude, that infinitely small Parts of those Bodies fly off with the *Electric Virtue*, and from their differently affecting the Olfactory Nerve, arises that Variety of Smells.

Top, and capp'd at Bottom with Brass, whereto hangs a Ball of the same Metal; this Tube when warm'd at the Fire, is hung upon the Cannon; [or on a Tube inserted into its Mouth] but it will not receive nor convey the *Electric Effluvia*, i. e. the *Electric Spark*, will be drawn off the Cap at the Top of the Glass Tube, by the approach of a Finger near it; but at the Brass at the Bottom there is no such Appearance, 'till a Wire be let down the Inside of the Tube which will then instantly communicate the *Electricity* to the Ball at the Bottom; and thus, the *Spark* may from thence be drawn off, as is usually done from any Part of the Chain.—The *Reason* why Glass will not receive the *Electricity*, see in the next Experiment.

EXP. VI.

IF a small *Silk Rope* about twelve Inches in Length, having a Loop at one End, and a Brass Ball at the other, be suspended from the Tube in the Mouth of the Cannon, the *Electric Virtue* will not run down the *Silk*, nor the Brass Ball be *electrified*.—The *Reason* is, that all *Electric Bodies*, as *Glass*, *Resin*, *Silk*, *Hair*, *Amber*, &c. have naturally when dry, a *vibratory*

tory Motion of their Parts, by which they emit this *Virtue* in a small Degree, and imperceptibly, and so are properly surrounded with a Sphere of their own; and the Pulses of each Sphere being in contrary Directions, they are thereby hinder'd from breaking in upon one another.—Hence also the *Reason* why the *Chain*, *Gun-Barrel*, &c. must be suspended from *Silk Cords*, or some other *Electric Body*, in order to prevent the *Electricity* going to the Ceiling.

IN this Experiment, if the *Silk Cord* be wet with *Water*, the *Electric Virtue* will run down it, and *electrify* the Ball; whence it is plain, that Water is a *Conductor* of *Electricity*. This shews us the *Reason*, why in moist Weather, the Experiments are not made with the same Success as in dry; because the *aqueous Particles* getting among the *Silk Cords* which suspend the *Chain*, *Cannon*, &c. convey part of the *Electricity* away:

EXP. VII.

IF two Downy Feathers, be tied at the two Ends of a *Flaxen Thread* about twenty Inches in Length, and the Middle of the Thread be
laid

laid upon the Tube inserted into the Mouth of the Cannon ; and, the two Feathers as they are thus suspended be brought together ; the *Electric Virtue* when it comes to the Thread, will divide itself, one Half running down one Part, and the remaining Half down the other Part of the Thread ; thus, each Feather will be strongly *Electrified*: The Consequence of which will be, the Particles of the *Electric Virtue*, issuing out of one Feather, will dash against those emitted from the other, and be mutually repell'd to the Distance of seven or eight Inches.—This Experiment plainly illustrates the *Reason*, why one *Electric Body* will not receive the *Electric Virtue* issuing from another.

EXP. VIII.

A round *Tin Plate* with a Handle, is fitted into the Mouth of the Cannon, and upon the Plate is set a Tea-Dish near full of warm Spirit of Wine ; the Spirit being thus *Electrified*, if a Finger be held near it, the Spark will be drawn off, and with a Snap kindle the rising *Fume*, and so set the whole on *Fire*.—And, if a Man be suspended by *Silk Cords*, or stands upon any *Electric Body*, as a Cake of *Resin*, &c. and

and holds with one Hand, the End of an Iron Rod over the Flame of the Spirit of Wine, (or that of a Candle set on the Tin Plate) he will, with a Finger of his other Hand, set fire to other warm Spirits held near it.—Hence it is evident, that Flame conveys *Electricity* without diminishing its Force*: And any kind of Matter, which sends forth when warm'd an *inflammable Vapour*, may be thus set on Fire.

ALSO *Gun-Powder* may be fired at Pleasure, by mixing it with *Camphire*, and reducing them both to a Powder in a Mortar; for a little of this *Composition*, being warm'd at the Fire, and apply'd to the Touch-hole of the Cannon, when charg'd with common Powder, will, at the Approach of a Finger take Fire; and by communicating it to the rest, will discharge the Cannon, tho' it be 100 Feet distant from the *Machine*.

EXP. IX.

IF a *Brass Plate*, by means of a Hook rivetted into the Middle of it, be hung upon the
Tube

* In like manner Smoke has been found to be a Conductor of *Electricity*.

Tube inserted into the Mouth of the Cannon; and under that another be set upon a Stand, about four Inches distant, with several small Pieces of *Leaf-Gold*, *Silver*, or any other light Bodies laid thereon; they will immediately fly from one Plate to the other, with incredible Swiftneſs, and often by the alternate attractive and repulſive Powers move backward and forward, in a very entertaining Manner, without touching either. And oftentimes a Piece of Leaf-Gold, will be ſuſpended in the Air between the two Plates, which affords a very ſurprizing and agreeable Appearance.—The *Reason* why Bodies are thus attracted, is, becauſe the Particles of the Glaſs, when put into a Vibratory Motion by Friction, throw out the *Æther* or *Electric Virtue* in great Plenty; and then its ſetting in again from all Parts to reſtore the *Equilibrium*, does impel, or forcibly carry ſuch light Bodies, as are in its way, towards the *excited* Body.

EXP. X.

To make the repulſive Power of *Electricity* more viſible, let there be a round *Tin Plate*, with a Handle fix'd into the Mouth of the Can-

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non,

non, and upon it let there be laid some Pieces of *Leaf-Gold*, *Brass*, &c. then, the Moment the *Electric Virtue* comes amongst them, they will all immediately be repel'd, as if blown away with a gentle Blast of Wind; nor will they come near the Plate, or Cannon again, till they have first discharg'd their *Electricity* by touching some *Non-Electric* Body. — The *Reason* why Bodies are thus repel'd is, because the *Electric Virtue* entring into those Bodies; they are impregnated therewith, and seem to become *Electrical* and to vibrate; and so throw off the subtile Matter again, till the Motion of its Parts are destroy'd by the Contact of some *Non-Electric*.—Now two Bodies, each surrounded with an *Electric Sphere* of their own, must repel each other, as is shewn in Experiment the Seventh.—Hence also the *Reason* why in the last Experiment, the Bodies were attracted a *Second*, *Third*, &c. Time, is, because each Time they are repel'd back to the lower Plate, they loose upon it all their *Virtue*, and so become again capable of being attracted.

EXP. XI.

ANOTHER Experiment to prove the Attractive and Repulsive Powers of *Electricity*,
may

may be this: Let a small Bell of a Clock, be fix'd to the Mouth of the Cannon, and another plac'd upon a Pedestal at four Inches Distance, exactly at the same Height, and let a small Cork Ball, about 3-4ths of an Inch in Diameter, having a Brass Ring fitted upon it, be suspended by a Silken Thread from the Ceiling, in the Middle between both, then will the Bell which joins to the Cannon, when *Electrified*, attract the little Ball; and, as it hangs by Silk, which is an *Electric Body*, it will retain all the Virtue it receives from the Bell; and therefore be repel'd from it, and thus be made to strike the other Bell; on which it will discharge all its *Electricity*, and become again a *Non-electric*, and so be attracted by the first Bell as before: Thus the Ball will continue to vibrate alternately between the two Bells, like the *Pendulum* of a Clock; and as it vibrates, will strike each Bell, making them ring: And, if the Room be dark, the Ball will be seen to receive and discharge alternately the *Electricity* as it strikes the Bells; and by a Contrivance of this Nature, four, five, six, &c. Bells may be rung together, which will produce a very agreeable Effect both to the *Eye* and *Ear*.

EXP. XII.

THE *Magnet* or *Loadstone*, attracts and repels, and so do *Electric Bodies*, when excited by Friction; but then, *Magnetism* differs quite from *Electricity*; for, the former attracts Iron only; the latter all Bodies, tho' the Effect is only sensible in light Ones.

IF a *Loadstone* arm'd with Iron, and cap'd with Brass, to which is suspended an Iron Key; be hung upon the Tube in the Mouth of the Cannon, by means of an Iron Wire; the *Electric Virtue* (at the Approach of a Finger) will issue out of every Part of the *Stone*, *Arms*, &c. with nearly the same Force, and the Key will remain suspended, in the same Manner as it was before the Stone was *Electrified*. Then if any Person lays his Finger upon the Chain to stop the *Electric Effluvia*, and a Plate, on which are laid light Bodies, as *Bran*, *Saw-Dust*, &c. be set under the *Stone*, at the Distance of three or four Inches; they will, the Moment the Finger is taken off the Chain, be strongly attracted and repel'd thereby.—Here we see two of the most considerable Powers of *Nature*, viz. *Electricity* and *Magnetism* acting
at

at the same Time, and which do no ways impede, destroy, or interfere with each others Action.

I SHALL now proceed to apply *Electricity* to the Solution of some surprizing *Phænomena*, which have not as yet been accounted for, in any satisfactory Manner. And,

First, OF the *Sensitive Plant*, whose Frame and Texture, is so very nice and Tender, that, at the least touch of the Finger, it will contract its Leaves, as if sensible of the Contact.—This wonderful *Phænomenon* is easily explicable upon the Principles of *Electricity*, as is evident by the following Experiment.

EXP. XIII.

LET a large Plumy Feather be tied to the Top of a small Stick, representing the Stalk of the Plant, which set in a Stand like a Flower-Plot; then place all upon the Tin-Plate, inserted into the Mouth of the Cannon, and the Moment the *Electricity* comes among the *Plumulae* or *Fibres* of the Feathers, it will cause them to open, extend, and expand themselves every way like

like the *Radij* of a Sphere, and this they do, because they are all possess'd with the same Virtue: Now if any Person approach the upper Part of the Feather with his Finger, it is really very beautiful to see how instantly the Feather is sensible of it, by closing up itself in the most surprizing Manner; upon taking away the Finger, the Feather, as it receives the Virtue from the Machine, will open and expand itself by Degrees, till it has quite recover'd its former Shape, and at the Touch of a Finger shut up again.— Just so acts the *Sensitive Plant*, which, as being endued with this Virtue *Naturally*, will, at the Approach of a Hand, or a Finger a *Non-electric*, immediately shut up, as having lost all its *Electric Virtue*; and will remain so till it has again receiv'd a Quantity of this *Virtue*, sufficient to distend the Leaves as before.

Secondly, Of the *Torpedo*, which is a Fish frequently found upon the Coast of *Provence* and *Gascony*, in *France*, in Shape of a Flounder; but in some Parts of *Africa*, in form of a Gudgeon; and is greatly fam'd among the antient and modern Naturalists, for a remarkable *Numbness* or *Stroke*, wherewith it strikes the
Hands

Hands, &c. of those who touch it, much resembling that painful Sensation felt in the Arm, upon striking the Elbow against a dense or solid Body. Some Authors have rais'd the Effects produced by this Fish to a Miracle; others attribute it to a Pair of Muscles in its Back, which upon contracting and suddenly dilating again, strike the Finger with great Force, and so cause that benumbing Sensation; but this (tho' the most prevailing Opinion) cannot be the Cause; for the *Torpedo* has been found to have this Property, after it has been dead some Time*. Some solve

* Mr. Moore, in his Travels into the Inland Parts of *Affrica*, gives us at Page 176, the following Account of the *Torpedo*.
 ' On the 1st of December 1733, some of the Natives having
 ' got a Net, came and desired I would go along with them to
 ' fish in the Lake over against *Yamaymacunda*. We caught a
 ' great Number of Fish, and amongst the rest one something
 ' like a Gudgeon, but much larger. None of them cared to
 ' touch it, neither would they suffer me to come near it, tel-
 ' ling me that it would kill me. Some of them got long Sticks,
 ' and touched the Fish with it; but as they found the
 ' Effect was not so very strong as they imagined, they cut the
 ' Sticks shorter and shorter, and even at six Inches Length the
 ' Fish had no Effect; but at last, when they touched it with
 ' their Fingers, they could scarce bear it. By this Time
 ' I understood it was a *Torpedo*, or *Numb-Fish*, and had the
 ' Curiosity of touching it with one of my Fingers, but in a
 ' Moment's time my Arm was dead quite up to my Elbow;
 ' as soon as I withdrew my Hand, my Arm came to itself
 ' again. I touched it a great many times, and found it have
 ' the same Effect, even after the Fish was dead. Then I or-
 ' dered one of the People to skin it, and found that the Qua-
 ' lity lay in the skin only; [not in the Flesh] which, when
 ' dried, had no Effect at all.

solve the Appearance one Way, and some another; but the most rational and satisfactory Account for the Cause of this benumbing Property of the Fish, is deducible from the Principles of *Electricity*, by supposing it naturally *endued* with this *Electric Quality*, which rushes out very forcibly upon the Finger of them who touch it. And that this is the Case, appears by the following Experiment.

EXP. XIV.

IF a *Flounder* be laid upon the Tin Plate, which is in the Mouth of the Cannon, and then strongly *Electrified*, it becomes an *artificial Torpedo*, and acts in every Respect, as a *Natural* one does. For, (1) upon touching the natural *Torpedo* with the Finger, the Person feels a Stroke, or something like a Numbness seize his Hand, and sometimes feels it to the Wrist and Elbow; but it goes off again in a few Minutes: Just so it happens to him who touches the *Electrified Flounder*. (2) As the *Torpedo* conveys its Numbness to the Hand, through *hard* and *dense* Bodies; but not thro' *soft* ones: So when the *Flounder* is touch'd with a long Piece of *Iron*, the benumbing Stroke is

is felt, but nothing is perceiv'd when touch'd with a *soft* Stick, tho' but six Inches long. (3) If the *Torpedo* be touch'd thro' the Interposition of any thin Body, as Cloth, &c. the Stroke is felt considerably: In the same manner it happens to the Person's Hand, who touches the Flounder with a Glove on. The Parallel might be carried further, but this I hope is sufficient to clear up this surprizing *Phænomenon*, and to set the Matter of the *Torpedo's* being an *electrified* Fish by Nature, [which may arise from its Texture, &c.] beyond all further Dispute.

BUT here it may reasonably be ask'd, how the *Sensitive Plant* and *Torpedo* can be *electrified* by Nature, to which I answer, that as the *Æther* is continually pervading the Pores of all Bodies, it may from their particular Textures and Juices be accumulated and retained in them [like as it is in the *electrified Pbial*] till some Body be brought near them, at which Time the *Virtue* will be discharg'd upon it. Nor is this Supposition at all ridiculous, for not only a few inanimate Bodies, as *Amber*, *Glass*, &c. but many animate ones, as *Cats*, *Horses*, &c. and even some Men themselves have been

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found

found to be *Electric*. If so, why may not some Vegetables? some Fish? &c.

I SHALL next proceed to shew the Action and Effect of *Electricity* upon the *Animal OEconomy*.

EXP. XV.

IF an half Pint Phial of clear Water be well cork'd, and a Wire, having a Hook at the Top, be run thro' the Cork, and thrust down near the Bottom, still leaving the upper Part standing about three Inches above the Neck of the Phial; this being hung upon the Cannon, the Wire will receive the *Electricity*, and the Water will be impregnated therewith, and the more, the longer it hangs upon the Cannon; [until it be quite *Saturated*] then a Person taking hold of the Phial with one Hand, is to approach the Cannon with a Finger of his other, and he will receive the *Electric Eruption* of *Fire* with a considerable *Explosion*, and *Shock* in his Arms and Breast equal to the Commotion of a real Cannon discharg'd.—The *Reason* is, because the *Electric Virtue*, running thro' the Wire into the Water, is there condens'd and
con-

confin'd by the *Electric Substance* of the *Glass*, which would otherwise run off and disperse; and as it acts in a greater *Quantity*, must therefore with a greater *Force*, than when it issues from the Cannon unconfin'd.—I have sent several Phials, after they have been *electrified* in this Manner, almost a Mile; and a Person there, by holding the Phial in one Hand, has, by touching the Wire with the other, receiv'd a violent Shock. And by this Method the *Electric Fire* has been retain'd in the Phial more than thirty Hours.

EXP. XVI.

THE Phial being *electrified*, as in the last Experiment, the whole Company communicate with each other by Wires; then the Person who stands first at one End of the Line, takes fast hold of the *electrified* Phial, and the Person at the other End draws off the Spark from the Cannon, and that Moment the whole Company receive the Shock by the *electric Virtue* rushing thro' them, which they feel very sensibly in both their Arms; but it generally goes off again in a few Minutes.

IF any one of the Company brings together the Ends of the two Wires in his Hands, he will not receive the *Stroke*; but if the Ends of the Wires are but half an Inch asunder, he will be shock'd in both his Arms, because his Body then becomes part of the *Circuit* of the *Electric Virtue*.

Note, IF the Person holds the Phial only with his Finger and Thumb, the Shock is scarce perceptible; but if he grasps it with his whole Hand, the Stroke is prodigiously stronger.—— Hence the Shock is in Proportion to the Number of Points of *non-electric* Contact; and this is more evident by the following Experiment.

EXP. XVII.

IF two half Pint Phials cas'd with very thin Lead, so as to touch in every Part, except the Neck, be fill'd with Pump-Water, and cork'd; with a Wire running thro' the Cork, as is usual, and hung to a Piece of strong Wire about five Inches long, with an Eye at each End to receive them; also a small Wire Loop must be fasten'd into the Lead on each Side of the Phials; and into these Loops a strong Wire, like the former,

mer, must be inserted; then if these Phials be hung upon the Cannon by the first Wire, [at the Ends of which they were suspended] and another Wire be brought from the lower Wire of the Phials, to lye upon the Floor; then the Phials being thus *electrified*, if a Person set his Foot upon the Wire on the Floor, and with his Finger touches the Cannon, he will receive a most terrible Shock at the *Wrists, Elbows, Shoulders, Back, Knees, and Ancles*. And if the *Electricity* were discharg'd upon a Person from twelve or fourteen of these Phials at once; it would in all Probability prove fatal to him.

Note, If any Person treads upon the Wire, and another touch but the Chain, without communicating with each other, they will both receive a violent Shock, tho' at 60 or 100 Feet Distance. And if the Room be dark, the Fire will be seen to run along the Wire on the Floor, in the Appearance of a *shooting Star*.—The Reason of our being more sensible of the Shock in the Joints, than in other Parts, is because the *Electric Virtue* in rushing thro' the Body, pervades the soft, yielding *Muscular Parts* thereof,

of, with little or no Resistance: But in the more dense, compact *Tendinous* Parts of the Body, the *Electricity* is greatly resisted thereby*; and the *Tendons*, as being very *elastic*, are put into *distractive* and *resistative Vibratory Motions*, which makes those Parts seem *weak* and *lax*, till they have again recover'd their former Tone. —Hence also the *Reason* why the Shock in this Experiment is always greatest in the *Tendon Achillis*, is, because that *Tendon* is the most firm and compact of any.

AFTER having *Electrified* the aforesaid Phials about fourteen or fifteen Times in the Space of three Weeks, there subsided a *yellowish Sediment*, which made me desirous of knowing the *Nature* of it; in order to which, I *filter'd* it with Care thro' fine *Cap-Paper*, and by that Means procur'd about four Grains of an *impalpable Powder*, resembling very much in Taste and

* Hence *Electricity* seems to be of the same Nature with *Lightning*, which is said to have dissolv'd Money, without burning the Purse it was in; and to have melted the Sword, without touching the Scabbard, and the like. Also *Aqua Fortis*, or *Volatile Salts*, will pass through soft Bodies without altering their *Texture*, whilst it spends its whole Force on hard ones, in which it finds the greatest Resistance.

and Colour fine levigated *Crocus Martis Aperiens*; and when mix'd with *Aqua Fortis*, produc'd a strong *Ebullition*, as did also the *Crocus Martis*. The Iron Wires in the Phials did not shew any Appearance of Decay or Waste, notwithstanding they stood in the Water all the Time above-mention'd.

EXP. XVIII.

IF a small *Tin Cup* or *Tea-Dish*, be fill'd with Water, and set upon the Tin Plate in the Mouth of the Cannon; and upon it be hung a *Syphon* so small as to let the Water only descend in gentle Drops; then will the *Syphon*, as soon as the Water is *Electrified*, run a constant Stream, and if the longer Leg thereof be bent at Right-angles, the Stream of Water will be projected to a great Distance. If the Room be dark the Water issues from the *Syphon*, something in the Appearance of Fire: which proves the *Electric Virtue* to be an unquenchable Flame.

EXP. XIX.

IF one of the Phials cased with Lead, having its Cork and Top nicely closed with *Sealing-*

ing-wax, be *Electrified* by laying the Wire upon the *Globe* ; you'll see, if the Room be dark, the *Electric Virtue* run into the Water, and when it becomes *saturated* therewith, the *Electricity* will burst out thro' the Cork and Wax in a visible *Flame*, attended oftentimes with an *Explosion* almost as great as that of a *Pistol*. And this gives us a very good *Idea* of *Thunder* and *Lightning* ; for the Water in the Phial may represent the thick *Cloud* ; the Eruption of the *Electric Fire*, the *Lightning* ; and the Explosion the *Thunder*.

IF any *Person* holds the Phial thus *electrified* in his Hand, and also a large Piece of Money, as a half Crown edgewise between his *Teeth*, drawing back his *Lips* ; and thus touches the Money with the Wire of the Phial, he will that Instant, receive a Terrible Blow, or Shock in his *Teeth* and *Jaws*, as will make him let the Money fall out of his Mouth ; notwithstanding he had made a *Resolution* to the contrary*.

EXP.

* By a Contrivance of this Nature, a covetous Man may be cruelly tantalized, by having exposed to his View a Heap of Gold within his Reach, yet dares not touch it though he was to have it for carrying away.

EXP. XX.

A PERSON standing upon a Cake of *Rosin* sixteen Inches square, and three Inches thick, laying one Hand upon the Cannon, will be all over possess'd with the *Electric Virtue*, and at the same Time feel nothing of it, unless a Stander-by puts his Finger near to any Part of his *Body*, and then the *Virtue* will be emitted in Form of *Fire* from that Part. And if *Leaf-Gold*, *Silver*, &c. be held near his Fingers, or any Part of his Body or Cloaths, it will be alternately attracted and repel'd thereby. Also if a *Vein* be opened in the Arm of a Person thus *Electrified*, the *Effluent Blood* will receive an *Impetus* therefrom, and spie out with much greater *Velocity*, and be projected to a much greater *Distance* than before.—Hence it is evident, that *Fluids in Motion*, have their Motion [in the *Human Body*] by the *Electric Virtue*, greatly *accelerated*.*

F

THUS

* Most of the foregoing Experiments I have made with a large *Glass Tube*, first standing upon the *Floor*, and afterwards upon *Rosin*, both in the *Sun* and in the *Shade*; but could never perceive (if the Air continued clear) any sensible Difference in the *Power* or *Strength* of the *Electric Virtue*. But a Person standing upon a Cake of *Rosin* will not receive the *Electric Eruption* from the *Chain* when he touches it, with near that Force

THUS having by such Experiments as are very material and conclusive * evidently prov'd,
 1. The Existence of a *fine, subtile, invisible Fluid* call'd *Æther*. 2. That it is of such a *pervading* and *penetrating* Nature, as to insinuate itself into the *Pores* or *Interstices* of all *Bodies*. 3. That *Elastic Bodies* by being put into *vibrating Motions* by Friction, throw it out, &c. 4. Which is the Cause of *Electric Attractions* and *Repulsions*. 5. That the *Electric Virtue* becomes a real *Flame of Fire*. And 6. Will kindle an inflammable Matter. Also 7. Accelerates the Motion of *Fluids*. Likewise, 8. Acts in a wonderful Manner upon the *Animal OEconomy*, &c. &c. this, I say being prov'd; I shall now add a Word or two, concerning the *Uses of Electricity*; which in all
 Pro-

Force which he does when he stands upon the *Floor*. The Reason of this is, because he is *Electrified* in a small Degree by standing on the *Rosin*, and therefore when he touches the *Chain*, &c. can only receive the Over-balance of the *Electric Virtue* therefrom.

* I could, if Time had permitted, have inserted a great many more Experiments, such as the Revolution of a small Ball round a large one, representing the Motion of a Planet round the Sun; and also, the Appearance of an infinite Number of Stars in a dark Room, &c. &c. But I shall take another Opportunity of communicating *These*, with the Causes of the *Revolutions* of the *Planets*; *Rotations* upon their *Axis's*, *Thunder* and *Lightning*; *Gravity*, &c. &c.

Probability may be very Great, and of the last Importance to *Mankind*; [for it is a common Maxim, *Nature does nothing in vain*] and some Experiments already exhibited upon the *Human Body*, seem to give us very convincing Proofs thereof.

FOR several People positively declare, that they have received great Benefit by *Electricity*, when terribly afflicted with *Rheumatic Pains*, in their *Arms, Legs, &c.**—Others with the most violent Pains in the *Teeth*, have been almost instantly reliev'd.—Several who have been let *Blood*, have, when *Electrified*, bled more freely than before.—But how, and in what manner this most wonderful and surprizing *Power of Nature*, may be apply'd to the Service of the *Human Body* with Success, must be left to the Judgment of the *Learned and Judicious PHYSICIANS*;

* There are several ways of *Electrifying* one Part of an Animal; Vegetable, &c. more than another, one of which is this: Let the Person or Vegetable to be *Electrified*, stand upon a Cake of Rosin, and let a *Non-electric* touch that Part; by this means all the Virtue emitted from the Globe into the whole Body, will run out at that Part, and consequently produce a greater Effect there than in any other Part.

Likewise there are Methods of *Electrifying*, so as to cause the Person *Electrified* to feel a particular Shock in the *Arm, Leg, Head, &c.* which Shock, if given moderate, and with Judgment, may undoubtedly be of great Service in removing several Obstructions, Paralytic Disorders, &c.

SICIANS; who, as being well acquainted with the Constitution and Texture of the *Human* Body, are consequently best qualified to consider and determine it.

BUT it is not at all wonderful, that there has not as yet been any certain Method of *Application*, since *Electricity* is but in its *Infancy*: For it is well known that the *Physical Sciences* are of all others most imperfect in their Beginnings, and leave most Room for future Improvements. Every Branch of *Natural Philosophy* requiring vast Numbers of Experiments infinitely varied and repeated, before it can be brought to any tolerable Degree of Perfection. Thus in the Case of *Magnetism*; though the attractive and repulsive *Virtue* of the *Loadstone*, was well known to *Thales*, *Pythagoras*, and other great *Philosophers*, who flourish'd near 3000 Years ago; yet the surprizing *Polarity* or *Verticity* of the *Needle*, now so happily apply'd to the Purposes of *Navigation*, is but a Modern Discovery; and the necessary and useful Knowledge of its *Variation*, and *Variation of its Variation*, &c. &c. is still later; and now of the greatest Importance to all the *World*.

F I N I S.



Additional

EXPERIMENTS.

THE *Electric* Stroke is not sensibly stronger from a *large* Electrified Bar of Iron, than from a large Wire; neither does a *solid Metallic Ball* attract, or repel, any stronger, than a *small one*. Therefore, 'tis evident the *Stroke*, the *Attraction*, or *Repulsion* Increases not in Proportion to the *Quantity of Matter*.

One of the Phials, coated with Lead, mention'd in *Experiment 17th.* being fill'd with *Steel*, or *Brass Filings*, or only cover'd on the inside with *Gold* or *Silver Leaf*; the Shock will be as violent, as from the same Phial fill'd with *Water*.—Therefore the Shock arises not from the *Quantity of Matter Electrified*, but from the *Number of Points*, in contact with the Phial.

If a *little Ball* of Wood is mov'd gently over an *electrified* Basin of Water, the Water will rise up under the Ball, and follow its Motion, in a *conoidical Form*, which very naturally Represents the *Motion*, and *Phænomenon*, of the Tides.

A half Crown put into a Scale suspended by *Gold Twist*, and another into the other Scale suspended by *Silk Lines*; the Piece in the *former* Scale will, when Electrified, *preponderate*, and weigh Considerably more than the *latter*, Notwithstanding, before the Machine was put into Motion, they were in perfect *Æquilibrio*.

If one of the Persons in *Exp. 16th* communicates with another by a *hempen Cord*, or a *soft Stick*, the *Shock* will not be perceptible to any of them.

If a Glas Tube be rubb'd briskly, and brought near a Feather floating in the Air, the Feather will be immediately *attracted*, and *adhere* to it, for 2 or 3 seconds of Time; when it will spring off, and be constantly *repell'd* even at the approach of the Tube, 'till it has discharg'd its acquir'd *electric Virtue*, upon some Body *non-electric*.

Note, A Glas Tube, by means of a Syringe, emptied of its Air, loses its Attractive and Repulsive Force, and the *Electric Virtue* seems to exert itself wholly within the Tube.—The same Thing happens to the Glas Globe when *exhausted*.

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